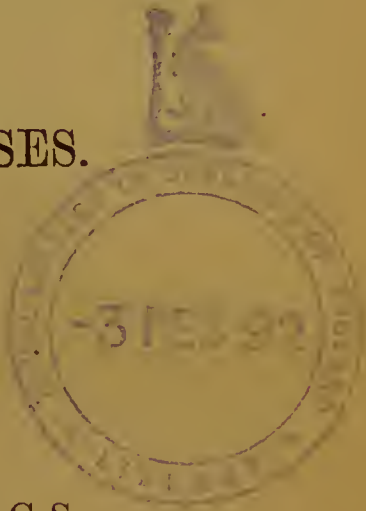


CONTRIBUTIONS TO THE SUBJECT
OF
COMPOUND FRACTURE;

BEING AN
ANALYSIS OF 302 CASES.

BY
THOMAS BRYANT, F.R.C.S.,
ASSISTANT-SURGEON TO GUY'S HOSPITAL.



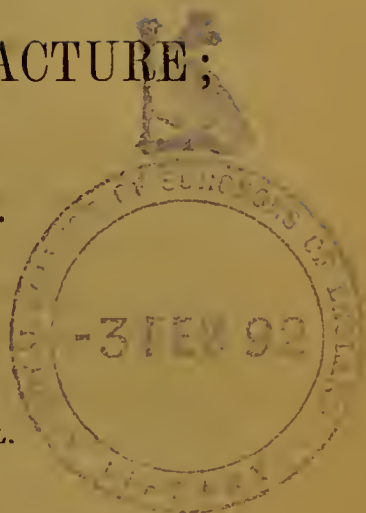
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RECOGNISING the truth that the science of medicine and surgery is one purely of observation, and that its principles and practice can only be regarded as sound, so long as they are based on the facts deduced from recorded and carefully observed phenomena, I cannot doubt that it is the duty of every practitioner to communicate to his professional brethren any positive material he may possess, and thus to add his quota towards building up the noble art and science to which we have the honour to belong. In conformity with this acknowledged principle, I have now the pleasure of presenting a brief analysis of upwards of 300 cases of compound fracture of the extremities. I have omitted those minor examples in which the smaller bones of the hands and feet were involved, and I believe that the results edueed are not unfruitful either of interest or instruction.

The cases have all occurred in Guy's Hospital during the last twenty years; my own notes have furnished me with

the particulars of all admitted within its walls during the last seven years, while the earlier cases have been collected from the records of the institution.

Analysis of the whole number.

Of the whole number of 302 cases—

17, or 5·6 per cent.,	were of the thigh.
193, or 63·9 „ „	leg.
35, or 11·5 „ „	arm.
57, or 18·8 „ „	forearm.

Eleven out of the 17 cases of compound fracture of the *thigh* proved fatal, or 64·7 per cent.

Seventy-four of the 193 examples of compound fracture of the *leg* were fatal, or 38·3 per cent.

Four out of the 35 cases of compound fracture of the *arm* died, or 11·4 per cent. And—

Seven, or 12·2 per cent., of the 57 cases of compound fracture of the *forearm*.

Of the whole number of 302 cases, 96 were fatal, or 31·7 per cent.

The causes of death in these 96 cases will be seen in the following table:

Table showing the causes of Death.

Causes.	Cases operated on.		Cases not operated on.		Total.	
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
Exhaustion.....	27	50·	12	28·5	39	40·6
Gangrene	5	9·2	6	14·2	11	11·4
Pyæmia	15	27·7	6	14·2	21	21·8
Delirium tremens	2	3·7	7	16·6	9	9·3
Bronchitis	1	1·9	3	7·1	4	4·1
Tetanus	—	—	2	4·7	2	2·
Secondary hæmorrhage.....	—	—	1	2·4	1	1·
Internal complications	4	7·4	3	7·1	7	7·3
Erysipelas	—	—	1	2·4	1	1·
Cause unknown	—	—	1	2·4	1	1·
Total.....	54	99·9	42	99·6	96	99·5

It would thus appear that, in cases subjected to amputation, pyæmia was twice as fatal as in those treated without that operation, and that exhaustion and gangrene are more common causes of death.

On the other hand, it would appear that in cases treated on ordinary surgical conservative principles, delirium tremens and tetanus are more common causes of a fatal result.

Bronchitis may, perhaps, be considered only as an accidental complication, and need not, therefore, be taken into the account.

Analysis of the cases of Compound Fracture of the Thigh.

Among the seventeen examples of compound fracture of the thigh—

9 underwent primary amputation	6 died, and 3 recovered.
1 „ secondary „	1 „ —.
7 were treated on conservative principles	4 „ 3 „

Thus, 10 were treated by amputation, and 7 of these died, or 70 per cent.

Seven were left to nature's efforts for repair, and of these 4 died, or 57 per cent.

One of these latter patients, a man aged twenty-seven, in whom no operation was called for, sank two hours after the injury. A second, aged thirty-two, died on the eighth day from tetanus. Another, aged fifty, sank exhausted from profuse discharge on the twenty-eighth day; and lastly, a man, aged fifty, died in the fifth month, from erysipelas coming on during the convalescence after hectic and free suppuration.

Amongst the cases proving *fatal after amputation*, one survived the operation but thirty-six hours. Two died on the third day, and one on the fourth, sixth, eighth, and fiftieth day, respectively. All died from simple exhaustion, the result of the accident, operation, or purulent discharge.

Remarks.—The *rarity* of compound fracture of the thigh

is a point worthy of notice, this accident bearing the proportion of only 5·6 per cent. to other cases involving the larger bones of the extremities. This fact is one which every surgeon in civil practice must be well prepared for, and that I should only have been able to collect seventeen examples of such an accident can therefore be no subject of surprise.

The *excessive mortality* of these cases is another point for observation, 64 per cent. of the whole number proving fatal.

In nearly 60 per cent. amputation was had recourse to, and 70 per cent. of these cases subsequently sank. The extreme severity of the injury in the majority of these instances rendered primary amputation absolutely essential, and the depression caused by the accident, operation, and secondary suppuration, proved too much for the patients' powers, death resulting in the large proportion above indicated.

Amongst the examples in which attempts were made to save the limb, more than half, or 57 per cent., subsequently died; two of the remaining successful cases were in boys aged twelve and fourteen years respectively, and the third was in a man aged thirty-two. In all three instances a good limb was the result.

When the experience of other men, and more particularly of military surgeons, is referred to, such a result is by no means a common one.

Dupuytren, Hennen, Larrey, Guthrie, and others, all agree that, in compound fracture of the thigh from gunshot wounds, "in rejecting amputation we lose more lives than we save limbs;" and also, "that in the *exceptional cases* which result in consolidation, the condition of the limb is not encouraging."

Macleod, after the result of his Crimean experience, advises amputation *in all* such cases when the fracture takes place in the middle and lower third of the thigh; and he hesitates only as to a like recommendation in cases of fracture of the upper third, on account of the extreme mortality of such amputations.

Malgaigne lost three out of five cases which were selected for conservative treatment. Baudens, out of twenty-five examples thus treated, saved only two, and these retained deformed members, unfit to fulfil their functions.

The limited experience which any single civil surgeon can bring to bear on this subject must be regarded as nothing when compared with that of his military brethren; but it would appear as a tolerably general conclusion that a satisfactory result can rarely be obtained, except in the most favorable cases, that is, when the subjects are young and the fracture uncomplicated, when the soft parts are neither materially damaged nor the bone comminuted.

In the case of a man which I have now under my care, and which is not included in my table, a limb has certainly been saved, but that is all; and it is a great question in my mind whether it can ever be a serviceable one. Months of delay, attended with profuse discharge and the occasional removal of dead bone, have passed away, and a deformed and ugly limb is the result. Often have I regretted that I had not long ago performed amputation, although, from other injuries complicating the case, primary amputation would not have been advisable.

We may, then, fairly conclude that in a non-comminuted fracture of the femur, made compound by a clean wound communicating with it, and taking place in a young and healthy subject, conservative treatment may be expected to prove successful. But when the bone is comminuted and the soft parts are seriously involved—a condition existing when the mechanical violence producing the accident has been great—a satisfactory termination of the case must be regarded with doubt. If the patient is old or unhealthy, and the local injury forbids any expectation of a natural recovery, amputation should be resorted to; and if the surgeon is disposed to doubt which practice he should adopt, I am tempted to believe that the removal of the limb is the safest and soundest practice. But if the subject of the injury should be healthy, and he is not subjected to injurious hygienic influences, and if the *broken and*

disconnected fragments of bone be at once removed, the wound being enlarged, if necessary, and absolute repose maintained, it is not unfair to believe that a satisfactory termination of the case may be obtained.

To leave the broken fragments in their position, with the hope of union, is but to leave a constant source of irritation, which must retard the local process of reparation as well as seriously weaken the powers of the patient. It is better practice to proceed at once to the removal of the offending and irritating osseous fragments than to leave them. They can but do harm by their presence, and at a later period their removal by a secondary operation will be a necessity.

Analysis of the 193 cases of Compound Fracture of the Leg.

In this number are included examples of compound fracture of the tibia and fibula ; very few, however, of the latter bone alone have been tabulated ; indeed, I possess the account of but one case, the result of a direct injury. I am not disposed to maintain that other instances may not have been recorded in my tables ; but of this there is no doubt, that it is a rare form of accident, and fortunately not of a very serious nature.

The remainder of the examples which I possess are of fracture of the tibia alone, or of both tibia and fibula combined, the latter being by far the most frequent.

Amongst the 193 examples of compound fracture of the leg are—

			Per cent.
129 treated on conservative principles	35 of which died, or	27·13	
32 underwent primary amputation of leg,	19	„	59·37
11 „ „ „ thigh,	6	„	55·55
15 „ secondary „ leg,	10	„	66·66
6 „ „ „ thigh,	4	„	66·66

74 of the whole number died, or 38·34 per cent.

27·13 per cent. of those treated without amputation died, and 60·9 per cent. of those in whom that operation was performed.

It is true that no comparison can be drawn between these two classes of cases, as the injuries for which amputation was performed were necessarily of a more severe nature than those which were treated by ordinary surgical appliances. Each case of compound fracture has peculiarities of its own, requiring its own special treatment.

It may be observed that, out of the whole number of cases—

16·5 per cent. were treated by primary amputation of the leg.

5·7 " " " thigh.

7·7 " " secondary " leg.

3·1 " " " " thigh.

66·8 " " on conservative principles, and of these
27·13 per cent. proved fatal, or rather more than one case in four.

Of those treated by amputation 60 per cent. proved fatal, the secondary amputations being the least favorable.

Every surgeon's experience will tell him of the comparative frequency of such an accident as compound fracture of the bones of the leg, and my tables plainly exhibit the fact that about 65 per cent. of all cases are of such a nature. Compound fracture of the fibula is by no means a common accident, and when it occurs a direct blow is its usual cause.

The causes of death in the fatal cases of compound fracture of the leg may be seen in the following table :

Causes.	Cases operated on.				Total.	Per cent.	Cases treated without operation.	
	Primary.		Secondary.				Total.	Per cent.
	Thigh.	Leg.	Thigh.	Leg.				
Exhaustion.....	3	9	4	3	19	29·7	10	7·7
Gangrene	—	1	—	3	4	6·2	6	4·6
Pyæmia	3	6	—	3	12	18·7	6	4·6
Delirium tremens	—	1	—	—	1	1·5	7	5·4
Bronchitis	—	1	—	—	1	1·5	3	2·3
Tetanus	—	—	—	—	—	—	1	·7
Secondary hæmorrhage ...	—	—	—	—	—	—	1	·7
Internal complications ..	—	1	—	1	2	3·1	—	—
Cause unknown	—	—	—	—	—	—	1	·7
	6	19	4	10	39	60·7	35	26·7

It will appear, then, from the above table, that about one third of the cases operated upon die from pyæmia, and nearly two thirds from exhaustion or gangrene; and that of the cases treated on conservative principles, not one sixth die from pyæmia, and something less than half from exhaustion and gangrene. Delirium tremens, however, is more fatal.

Cases of the former class are apparently more liable to pyæmia than the latter, and exhaustion and gangrene are more fatal in them.

It has already been observed that no comparison can be drawn between the two classes of cases—the one treated with amputation, and the other without it; but in compound fracture of the leg the injury should be very extensive to warrant such a practice as amputation. Whether treated by primary or secondary amputation, a large proportion of the cases terminate fatally—about 60 per cent.; and when attempts to save the limb are carried out, by care and close attention good results may be anticipated.

Let a free exit be made and kept up for the evacuation of all pus, let loose pieces of bone be removed *as early as possible*, and let the limb be preserved in absolute repose by any splint which will secure such an end, the ordinary interrupted splint being placed over the wound. Let the tendo Achillis be divided if the slightest difficulty is experienced in maintaining rest, and good support and nourishment be freely given. Under such treatment apparently hopeless cases often turn out well, and reward the surgeon's attention by a successful result.

If such means fail, secondary amputation may be resorted to; for the chance of success by such a measure is nearly as favorable as if a primary amputation had been performed. In several very bad examples which have passed under my observation, and in which success was subsequently secured, free incisions were made wherever pus was present, and I am disposed to believe that such a practice tended much to secure this desirable end. By such treatment all burrowing is prevented, and constitutional dis-

turbance lessened ; it is a practice which I have never seen followed by any other than a good result, and I would suggest its more frequent adoption whenever suppuration follows compound fracture.

Analysis of the 35 cases of Compound Fracture of the Arm.

14 were treated on conservative principles, and all recovered.

4 „ by primary amputation at the shoulder-joint, and two of these died.

13 „ by primary amputation of the arm, and two died.

4 „ by secondary amputation, and all recovered.

Thirty-one of the whole number recovered, and 4 died, or 11·4 per cent.

One of the fatal cases in which amputation at the shoulder joint was performed died within twenty-four hours, from some internal complication, and the second on the fifteenth day, from the same cause.

One of the fatal cases after primary amputation of the arm took place in a child aged five and a half, who sank on the fourth day, and the second in an adult, who died from pyæmia in the third week.

On the whole, the result of these cases must be regarded as satisfactory, 89 per cent. recovering. Two cases evidently died from internal complication, one child from the severity of the injury, and one from pyæmia.

Analysis of the 57 cases of Compound Fracture of the bones of the Forearm.

27 were treated on conservative principles, and all recovered.

22 „ by primary amputation of forearm ; 2 died, or 9 per cent.

5 „ by secondary amputation { 4 of forearm ; 1 died.
1 of arm ; 1 died.

3 died from internal complications.

One of the patients dying after primary amputation sank with delirium ; a malformed brain and evidence of old arachnitis were discovered after death.

In the second, pyæmia was the cause of death on the twenty-fifth day.

The secondary amputation of the forearm was fatal from exhaustion, the operation having been performed on account of gangrene of the extremity.

The case of secondary amputation of the arm proved fatal from pyæmia coming on five days after the operation: this patient sank four days subsequently.

The favorable termination of these last two classes of cases is borne out by the experience of all surgeons. Such an operation as amputation would of course be only resorted to in the severest examples; and in the more favorable cases a good recovery may, with some confidence, be anticipated.

The majority of the cases of compound fracture of the forearm which are admitted into Guy's Hospital are caused by machinery, and, as a consequence, a complete destruction of the part too frequently exists; this fact explains why so large a proportion of cases are treated by amputation—about 50 per cent., or half of the whole number.

A small percentage of those only are fatal.

The cases of less severity, which are treated by ordinary measures, are most successful, no fatal instance having been recorded.

The analysis, such as it is, I leave to the notice of the Society; I have not attempted to draw up any general conclusions, as I feel that they would be of little value. I know of no cases in surgery which require to be treated more upon their individual peculiarities than those of compound fracture, and, as a consequence, have not compared the relative success of the cases treated by amputation and those not operated on. I cannot but believe, however, that the members of the Society will find much of interest in the material thus laid before them.